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## **Baking Time and Watt-Hour Consumption in Baking Potatoes Wrapped in Aluminum Foil Shiny Side Out and Dull Side Out, Plain, and Oiled in a Range Oven, Rotisserie Oven, and Toast-R-Oven**

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To the Graduate Council:

I am submitting herewith a thesis written by Nancy Lou Lawson entitled "Baking Time and Watt-Hour Consumption in Baking Potatoes Wrapped in Aluminum Foil Shiny Side Out and Dull Side Out, Plain, and Oiled in a Range Oven, Rotisserie Oven, and Toast-R-Oven." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Human Ecology.

Lyle Mamer, Major Professor

We have read this thesis and recommend its acceptance:

Lorna J. Gassett, Ilene Brown

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

August 8, 1963

To the Graduate Council:

I am submitting herewith a thesis written by Nancy Lou Lawson entitled "Baking Time and Watt-Hour Consumption in Baking Potatoes Wrapped in Aluminum Foil Shiny Side Out and Dull Side Out, Plain, and Oiled in a Range Oven, Rotisserie Oven, and Toast-R-Oven." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Home Management.

Lyle Manner  
Major Professor

We have read this thesis and  
recommend its acceptance:

Lorna J. Gassett  
Gene Brown

Accepted for the Council:

Hilton A. Smith  
Dean of the Graduate School

BAKING TIME AND WATT-HOUR CONSUMPTION IN BAKING POTATOES  
WRAPPED IN ALUMINUM FOIL SHINY SIDE OUT AND DULL  
SIDE OUT, PLAIN, AND OILED IN A RANGE  
OVEN, ROTISSERIE OVEN, AND  
TOAST-R-OVEN

---

A Thesis  
Presented to  
the Graduate Council of  
The University of Tennessee

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In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

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by  
Nancy Lou Lawson

August 1963

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N. L. L.

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## CHAPTER I

### INTRODUCTION AND STATEMENT OF PROBLEM

Today's women, who have a dual career as a homemaker and as a professional person, welcome work simplification methods with "push button" cooking devices to allow them time for other activities. The range oven may provide the homemakers with "set it and forget it" cooking. For additional baking area, simultaneous baking at different temperatures, and baking small quantities of food, small supplementary ovens may be purchased. When a homemaker has a choice as to the appliance she uses in food preparation, she needs to be able to answer the following questions in making her decision: How much time is required to preheat and to cook the food in the equipment? How much energy is consumed by the appliance to do this job?

Aluminum foil is usually considered another aid to the homemaker in food preparation. The advantages claimed are that it reduces the time needed to cook the food and to clean the equipment after cooking. Some individuals recommend it as a means of heat retention. Does a foil wrapping on a potato give one a decided advantage in cooking time as compared to baking a plain or oiled potato? Does it make a difference which side of the aluminum foil is to the outside?

The potato holds an important place among the leading foods of the world, ranking, in total production, above any other vegetable crop. According to The National Food Situation (2, p. 4), of the major



food commodities, 10<sup>4</sup> pounds of white potatoes per capita were consumed in 1962 or about two pounds per person per week. (Two pounds are equivalent to six medium sized potatoes.) The popularity of potatoes may be attributed to long storage life, availability, convenience, economy of serving, ease of digestibility, nutrients provided, and the bland flavor which blends well with almost all foods.

As a result of its wide distribution, common usage, and adaptability to test procedures, it has commanded the attention of many writers and research workers. These writings were concerned primarily with the history, the production standpoint, cooking quality, or chemical composition, with less attention directed toward time and energy consumption within the various baking methods.

This study compares the baking time and energy consumed in baking potatoes wrapped in aluminum foil shiny side out and dull side out, plain, and oiled at 425° F. in a range oven, Rotisserie Oven, and Toast-R-Oven. The temperature selection of 425° F. (218° C.) was based upon its common occurrence in cookbooks for baked potatoes and upon the recommendation of Dr. Ada Marie Campbell, Professor of Foods at the University of Tennessee.

The objectives of this study were to compare the baking time and the watt-hour consumption in baking potatoes wrapped in aluminum foil shiny side out, dull side out, plain, and oiled in a range oven, Rotisserie Oven, and Toast-R-Oven. Variables controlled were size, weight, and temperature of the potatoes, temperature of the room, oven temperature, end point of baking, and line voltage. Questions should

be answered concerning the significance of space provided for cooking, difference in baking time required of each to reach a point of doneness, and difference in watt-hour consumption.

As a result of this study it is hoped that recommendations might be provided for the homemaker in regard to economical practices for the use of different appliances as an oven and a preferable method for the preparation of the potatoes for baking.

## CHAPTER II

### REVIEW OF LITERATURE

A review of literature reveals no published reports comparing the oven range, Rotisserie Oven, and Toast-R-Oven nor pertaining to a preferable method of baking with foil or the effect foil has on baking media. Revelant factors from studies applicable to this study are reviewed here.

#### I. HEAT TRANSFER

Heat penetration of the baked potato involves all three heat processes--convection, conduction, and radiation. Convection takes place as the colder heavier air in the oven falls and the warmer, lighter air rises. The intermingling of the hot and cold air tends to equalize the distribution of heat energy as the oven heats. Conduction transfers heat from particle to particle in the potato. A metal skewer inserted into the potato is often recommended to speed up conduction. Radiant energy may be reflected, absorbed, or transmitted; the relative amounts will depend upon the physical properties of the material which the radiant energy meets. Part of this energy is always absorbed if it passes through a material medium. Littleton and Phillips (8, p. 527) reported in their 1932 study that an electric oven had more than twice the radiation heat as convection. The manufacturers of the Rotisserie Oven and Toast-R-Oven use aluminum and

chromium as oven lining. These shiny surfaces spread radiant heat uniformly throughout the oven.

According to Peet (13), the recently developed electronic range transforms 230 volts AC to 5,000 volts DC which is converted into high-frequency microwave energy that operates on the principle of radiation. Microwaves penetrate about two inches into the food, agitate the molecules, and produce the heat that cooks the food. One potato bakes in four minutes, but baking several potatoes takes two or three times as long as baking one.

An experimental foods study entitled "Heat Penetration of Baked Potatoes" conducted by Wanda Jordan (4) under the supervision of Dr. Ada Marie Campbell compared potatoes baked on a skewer and without a skewer using no foil, foil shiny side out, and foil dull side out. There was no attempt to control the potato size or weight. The test was repeated four times for each method using the boiling point of water to establish a point of doneness. A thermometer was inserted into the potato to determine the internal temperature. It was found the average baking time for dull side out required longer than shiny side, but the potatoes with no foil baked in the shortest time. Although no difference in interior was noticed, the ones baked in foil were soft and moist on the outside. Baking with a skewer required longer time in each case except when the shiny side of the aluminum foil was on the outside. She concluded that the thermometer placed in the middle of the plain potato may act as a skewer allowing for more heat conduction and thus offset the difference in baking.

## II. HEAT LOSS

Oven heat loss results in increasing energy consumption. Lowe (9) reported tests performed by Burke and Niles indicated a variation in oven temperature of as much as 25° from the optimum temperature affected the quality of baking. Redfield (16) found that oven heat loss was dependent upon interior finish, insulation, temperature setting, and room temperature. The greater the difference between internal temperature and room temperature the greater was the heat loss. In calibrating thermostats' accuracy in the equipment laboratory at the University of Tennessee, it has been found that a constant voltage applied to an appliance resulted in a steady rise in temperature to above the temperature setting. As the oven continued to cycle on and off the difference in temperature became less after two or three cycles. This difference varies from range to range. In a thermostatically controlled appliance the energy input is sufficient to maintain the desired temperature and take care of heat losses.

## III. ENERGY CONSUMPTION AND PREHEATING

Energy consumption may also be affected by the length of the preheat period. Redfield states (16, p. 7):

The amount of energy required to preheat an oven to a desired temperature depends upon the dimensions of the oven, insulation, size of the heating coils, and the thermal efficiency of the oven.

In her study of baking performance and energy consumption of the large and small ovens of two electric ranges, Wheeler (20) found the

small ovens required a longer time to preheat than was required by the large oven. The large ovens required more electrical energy both for preheating and baking but produced a more satisfactory product than the small ovens.

Lenore Thye and Faith Churchill (18, pp. 11, 12) of the Agriculture Research Service did a study of the cooking performance of two roaster ovens and rotisserie ovens compared with range ovens. Two typical dinners were baked. Maintenance of high and low temperature ability, evenness of heat distribution, electric energy costs, and cooking time were taken into consideration. The portable ovens baked good products but the range ovens browned food more evenly. Better browning in the range ovens resulted from a larger capacity for air circulation and from a better balanced heat input provided by lower and upper heating elements. Portable ovens used less total electricity but took more time than range ovens. Preheating the lower wattage ovens took 20 per cent longer for the roaster and 9 per cent longer for the rotisserie ovens which accounted for the main difference in cooking time.

Wright (21) compared the baking performance and energy consumption of two electric roasters with two small ovens of double oven ranges. Her study indicated that small ovens require less time for preheating and consume less energy than roasters. Peet and Thye (15) reported the roaster required a longer preheat period than the range oven. This can be attributed to the amount of insulation and wattage rating.

In an earlier study, Peet and Lowe (14) reported a reduction in time to bake foods in a preheated oven. The difference in energy consumption was almost negligible.

#### IV. BAKING WITH A FOIL COVERING AND OIL COATING

June Majhor (10), in her work on "A Comparison of Roasting Turkey by an Open-Pan and a Foil-Wrap Method," found that foil tended to delay heat penetration. An increase of 125° temperature setting was recommended over the conventional method when using foil as the turkey dried out at a lower setting. The cooking time was then shortened, less moisture lost, but more energy was consumed.

Wrapping in foil is convenient. However, according to Mrs. Elsie Keeney (5, p. 3), consumer information specialist, one gets a steamed rather than a baked potato which is similar to the difference between a dry heat roast and a pot roast. Rubbing the potato with fat before baking makes them tasty but, she says "takes from the crisp nutty character."

#### V. CHOICE OF BAKING MEDIA

Kotschevar (6, p. 136) says potatoes should be selected on the basis of use. Potatoes for baking should be grown in light soil with good drainage as in a mountain area. Chosen most often for baking is the mature potato which has a higher starch content. Another indicator of suitability for use is the specific gravity of the potato. A specific gravity of 1.08 or below indicates a good baking potato.

Studies conducted by Oregon State College Home Economics Research Laboratory (12, p 2) show that potatoes containing a high portion of dry matter are fluffy, light, and mealy when baked. They predict potatoes of the future will come to the market labeled according to best cooking method such as baking, boiling, or frying. Homemakers may separate their own potatoes by using a simple do-it-yourself method. Dissolve  $3/4$  cup salt in three pints of water. Stir the solution and let stand 24 hours. Test the potato by dropping into the solution. Those that sink should be baked. Those that float are for boiling. Rinse the salt from skins if baking.

In a study (3, pp. 1-17) entitled "Cooking Quality and Compositional Factors of Potatoes of Different Varieties from Several Commercial Locations," United States Department of Agriculture researchers found that mealiness is not a function of variety alone and could not be used as sole criteria for cooking quality. They found length of storage to be an important factor in palatability, the potatoes were less mealy and more soggy the longer stored. No two potatoes from the same variety or from the same hill were found to be identical in chemical composition. Factors the report lists as affecting composition are: variety, degree of maturity, method of cultivation, amount and kind of fertilizers, locality and soil properties, seasonal variations, temperature during growth and storage, and time in storage.

Four uniform tubers, one containing the thermocouple, comprised each of the samples baked at one time in the study by the United States Department of Agriculture investigators. The potatoes were washed,



dried, weighed, and baked in an oven set at 425° F. until an internal temperature of 98° C. (208° F.) was reached. These potatoes were selected according to specific gravity and taken from storage 20 hours before baking and removed to a 70 - 80 degree laboratory room. Cooking time varied from 40 to 60 minutes. The consistently dry Russet Burbank had the highest mealiness score. The mealiness increased with an increase in specific gravity.

## VI. DONENESS STANDARDIZATION

In early food research studies one of the controls most sought was standardization of the end point of cooking or the doneness of the product. Piercing cooked potatoes with a fork or skewer to determine ease of penetration and thus relative doneness was one of the first methods employed. This method is purely subjective as it depends upon the judgment of the worker. If characteristic texture differences occur among samples, the piercing method may not truthfully indicate the same degree of doneness from sample to sample. Variation in judgments may also occur.

As early as 1917 Langworthy (7) discussed the relationship between internal temperature and doneness of potatoes. He reported that doneness was obtained in the interior of potatoes at a temperature of 212° F. when boiled or baked. At that time thermocouples with potentiometers were used for obtaining internal temperature of food. The use of this instrument marked a beginning in scientific control of experimental procedure but was laborious and subject to error.

Other methods to determine the point of doneness include the use of a penetrometer (17) which measures the amount of pressure required to penetrate the food in a specified time; boiling point of water method using a thermometer, based on Lowe's (9) statement that starch is of better consistency at 95° C., taste panels, and copper-constantan thermocouples attached to an electronic recording potentiometer.

The American Standards Association (1) recommends centrally locating and extending the thermocouple junction two inches from any metal part on the oven rack to measure oven temperature. The use of two potentiometers allows for recording oven temperature as well as internal food temperature.

## CHAPTER III

### PROCEDURE

#### I. EQUIPMENT USED

##### Range

The range oven used for this problem was a Hotpoint, model number 109 RC 45-A, of 17" x 21 1/2" x 19 1/2" dimensions or 7127 cubic inches capacity, rated 230 volts, 60 cycles, AC only. The 425° F. setting was used.

##### Rotisserie Oven

The General Electric thermostatically controlled Rotisserie Oven, catalogue number R20, with a copper-tone body, satin finished aluminum lid, and chromium plated interior well was used. Its upper and lower calrod heating element operates on 60 cycles AC only. Interior dimensions are 18" x 13 1/2" x 11" or 2,673 cubic inches capacity. It is rated at 120 volts and 1500 watts. The Rotisserie Oven is not insulated.

##### Toast-R-Oven

The General Electric Toast-R-Oven, catalog number T93, was used. It is rated at 120 volts, 1200 watts, AC only, with dimensions 11 1/4" x 6 3/4" x 3 1/2" or 266 cubic inches capacity. Electric coils located at the top and bottom of this appliance are enclosed in glass tubes.

## Devices for Measuring

### 1. Voltage

Two AC voltmeters with zero to 300 volts and zero to 150 volts range were used to determine voltage input into the range and smaller appliances. Both were made by General Electric, Schenectady, New York.

Two variacs, type V-10 HM with zero to 260 volts and type V-10 with zero to 130 volts range were used to maintain a constant line voltage for the range and smaller appliances. The variac of 230 volts operates on 50 to 60 cycles, 10 amperes. The variac with 130 voltage operates on 50 to 50 cycles, 20 amperes. Both instruments were made by General Radio Company of Cambridge, Massachusetts.

### 2. Watt-hour consumption

Two watt-hour meters were used: one was rated at 10 amperes, 240 volts, 3 wire, 60 cycles, kh 1 1/3, and the other at 5 amperes, 120 volts, 60 cycles, kh 1/3. These meters were made by Duncan Electric Company of Lafayette, Indiana.

### 3. Temperature and relative humidity

The thermostat in the control room was set at 72° F. but the temperature varied from 68 to 74 degrees. A Brown hygrometer with a self-contained thermometer, model 612X21K, was used to record the temperature and relative humidity of the control room. This instrument was manufactured by Minneapolis-Honeywell, Brown Instrument Division, Philadelphia, Pennsylvania.

Two Brown Recording Potentiometers, model # 153X60Pl6-X-61Fl, serial # 60043, zero to plus 800° F. Range, 60 cycles, 110 to 125 volts,

with copper-constantan thermocouples were used to measure the internal temperature of the potato during the baking process and also to measure oven temperature at the same time. The potentiometers were made by Minneapolis-Honeywell, Brown Instrument Division, Philadelphia, Pennsylvania.

#### 4. Time

Celebar stop watches were used to measure the time required for preheating the ovens to 425° F. and for baking the potato to the desired internal temperature.

#### 5. Weight

Torsion Balance scales, accurate to .2 gram, and weights were used to weigh the potatoes.

#### Tools for Preparing Testing Media

From directions given by Meredith (11), an instrument was devised to determine the center of a potato and to make a hole at the center of the mass inserting a thermocouple. The instrument consists of a six-inch and four-inch pipe joined by an elbow joint to make it perpendicular. A short piece of iron with an adjustable screw in the center was welded to the hypotenuse of the angle iron which in turn was welded to the end of the arm. A steel wire was inserted between the screw and the 90° angle. The base was securely attached to a board on which were marked parallel vertical and horizontal lines one-fourth inch apart from the center of the board which the steel wire made.

The depth of the potato was measured by centering the potato on

the board underneath the wire by means of the cross lines. The potato was placed to rest in a natural position. The steel wire was lowered to touch the potato. The screw was tightened. The distance from the board to the end of the wire was measured. Then the wire was forced one-half the measured distance into the potato making a hole large enough to insert the thermocouple.

## II. TESTING MEDIA

### Potatoes

U.S. No. I Idaho Russet potatoes purchased April 1, 1963, on the Forest Avenue Market were selected to obtain a mature, dry, and mealy potato best suited for baking. By storing the potatoes in the hydrator drawers of a refrigerator, the internal temperature could be controlled. The quantity to be used for each test were washed, dried, and stored in plastic bags in the temperature control room 48 hours before cooking.

### Aluminum Foil

Twelve-inch width household aluminum foil was measured and torn off at eight-inch intervals for a standard foil size each time. The same kind of foil was used throughout the testing.

### Vegetable Oil

Wesson Oil, a refined cottonseed oil, was used throughout the testing. It was applied thinly on the potatoes and allowed to drain on paper toweling.

### III. BAKING PROCEDURE

Pretesting was necessary to eliminate or control known variables before doing the actual tests. A discussion will follow of those items that have not been described elsewhere in this work.

The ovens were calibrated to obtain a comparable temperature range at 425° F. One potentiometer was used solely for recording oven temperature while the other recorded potato internal temperature. The thermocouple for the oven temperature was placed on the center rack of the range oven and Rotisserie Oven two inches from any metal portion. The thermocouple wire was wrapped around the potato to the right of the Toast-R-Oven center as the four potatoes baked on a tray. The potato to the left of the center of the ovens contained the thermocouple that measured internal temperature. The potatoes and thermocouples were always placed in the same position. Care was taken not to touch another potato in the baking process.

Agriculture Handbook Eight (19, p. 81) allows three potatoes to a pound. As the 1960 United States Census listed 3.5 members per family, four potatoes were chosen to serve a family of four. The total weight of the potatoes used was 604.8 grams. The potato in which the thermocouple was inserted weighed 151.2 grams. The other three potatoes were approximately the same size and weight.

Room temperature was maintained 68° to 74° F. A constant humidity could not be maintained although a dehumidifier was used. The relative humidity ranged from 16 to 58.

The following procedure was used for each test:

1. The potatoes were washed, scrubbed, and dried with a paper towel, then placed in a plastic bag and transferred to the temperature control room to be stored 48 hours before baking.
2. The hygrometer with a self-contained thermometer was wound and a chart inserted to record temperature and relative humidity of the temperature control room.
3. The scales were balanced. The control potato was weighed and cut, if necessary, to weigh 151.2 grams. Three other potatoes were added and adjusted to a total weight of 604.8 grams.
4. The center of the potato was determined and a hole was made for the thermocouple.
5. The potatoes were left plain, oiled, or wrapped in foil according to the test being run.
6. The thermocouple was inserted into the control potato and placed in the oven to be used. Another thermocouple was twisted around the oven rack in the center of the range oven and Rotisserie Oven. In the Toast-R-Oven the thermocouple was wrapped around the potato to the right of the control potato. The oven door was closed.
7. The recording potentiometers were turned on and allowed to standardize.
8. The watt-hour reading on the watt-hour meter was recorded. The voltage was adjusted to be 230 for the range oven and 115 for the Rotisserie Oven and Toast-R-Oven by the use of a variac.
9. Two stop watches were started as soon as the oven was turned



on. One watch was stopped when preheat time was reached and this time was recorded. The watt-hours required for preheating were recorded.

10. The oven was turned off when internal temperature of the potato reached 210° F. Total time and watt-hours were recorded.

Recording potentiometers were turned off.

11. The oven was allowed to cool before doing another test.

#### IV. STATISTICAL ANALYSIS

The analysis of variance test was used to check the significance of the apparent differences in time and watt-hour consumption.

## CHAPTER IV

### RESULTS AND DISCUSSION

The objectives in this study were to determine whether or not there were any significant differences in the amount of baking time and watt-hour consumption using the methods of wrapping potatoes in aluminum foil shiny side out, dull side out, plain, and oiled baked in a conventional range oven, Rotisserie Oven, and Roast-R-Oven. Analyzed in this chapter are time and watt-hour requirement data for each of the different methods of baking potatoes used in this investigation.

Tables V, VI, and VII in the Appendix give baking time and watt-hour consumption for six replicas in each of the three ovens using the four methods of preparing the potatoes for baking.

The data in Table I show that when using the range oven and the Toast-R-Oven, the order of increasing baking time for the four methods was oiled, plain, dull aluminum, and shiny aluminum. For these ovens there was no pattern of increasing order for the watt-hour consumption (see Table II). In the range oven the watt-hour consumption increases in this order: plain, shiny aluminum, oiled, and dull aluminum but in the Toast-R-Oven the order of increase was dull aluminum, oiled, plain, and shiny aluminum. The order of increasing baking time and watt-hour consumption for the Rotisserie Oven is plain, oiled, shiny aluminum, and dull aluminum. From these findings it was concluded there was little difference between shiny aluminum and dull aluminum for baking. Little difference also

TABLE I

AVERAGE PREHEAT TIME AND AVERAGE TOTAL BAKING TIME  
IN EACH OVEN FOR BAKING POTATOES BY FOUR METHODS

Method	Average preheat time						Average total baking time					
	Range oven		Rotisserie oven		Toast-R-oven		Range oven		Rotisserie oven		Toast-R-oven	
	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.
Shiny aluminum	8	36	14	27	1	25	50	28	42	04	51	21
Dull aluminum	8	00	12	18	1	31	48	05	48	52	42	26
Plain	8	19	14	45	1	35	40	07	35	28	41	26
Oiled	8	06	15	11	1	30	36	34	37	59	35	43
Average	8	15	14	10	1	30	43	48	41	06	42	44

TABLE II

AVERAGE PREHEAT AND AVERAGE TOTAL WATT-HOUR CONSUMPTION  
FOR EACH OVEN BY FOUR METHODS

Method	Average preheat watt-hour consumption			Average total watt-hour consumption		
	Range oven	Rotisserie oven	Toast-R-oven	Range oven	Rotisserie oven	Toast-R-oven
Shiny aluminum	499	279	27	936	730	430
Dull aluminum	520	272	29	980	829	350
Plain	512	302	29	921	671	421
Oiled	481	332	29	943	714	351
Average	503	296	28	945	726	388

existed between the plain and oiled method. Greater differences existed between the foil methods and the plain or oiled method.

Table I shows that the average preheat time for the range oven was about three-fifths the time required of the Rotisserie Oven and nine and one-half times longer than the Toast-R-Oven. Total time for baking was almost the same for the three ovens. The range oven required one to two minutes longer than the small ovens to bake.

The watt-hours consumed for preheating the range oven was 1.7 times more than the Rotisserie Oven and about 18 times more than the Toast-R-Oven (see Table II). For total watt-hours consumed, the range oven required on the average of about 1.3 times the watt-hours required of the Rotisserie Oven and 2.4 times that of the Toast-R-Oven. It must be kept in mind that the range oven operates on 230 voltage while the other two ovens use one-half this amount. The capacity of the range oven is about 2.7 times larger than the Rotisserie Oven and about 27 times larger than the Toast-R-Oven. Neither the Rotisserie Oven nor Toast-R-Oven have insulation; for the nature and purpose of the Rotisserie Oven, several vents are located on the back of the Rotisserie Oven lid allowing heat escape.

The F values obtained in the analysis of variance for the baking time and the watt-hour consumption are given in Tables III and IV.

The principal findings established by this investigation are as follows:

1. As far as the ovens used were concerned, any difference in time requirements to bake potatoes may be attributed to chance. However,

TABLE III  
ANALYSIS OF VARIANCE OF BAKING  
TIME IN SECONDS

Source of variation	Sum squares	Degrees of freedom	Mean squares	F	F .95 F .99 .995
Between ovens (columns)	303,950	2	151,975	2.15	3.15
Between methods (rows)	5,975,800	3	1,991,933	28.3***	6.17
Interaction	1,836,130	6	306,022	4.35**	3.12
Subtotal	8,115,880	11	737,807		
Within groups	4,216,870	60	70,281	10.5***	3.43
Total	12,332,750	71			

\*\*Very significant at the F .99 value.

\*\*\*Very highly significant at the F .995 value.

TABLE IV  
ANALYSIS OF VARIANCE OF WATT-  
HOUR CONSUMPTION

Sources of variation	Sum squares	Degrees of freedom	Mean square	F	F .95 F .99 .995
Between ovens (columns)	3,799,435	2	1,899,718	542.6***	7.76
Between methods (rows)	30,840	3	10,280	2.93*	2.76
Interaction	94,568	6	15,761	4.49***	4.37
Subtotal	3,924,843	11	356,804		
Within groups	210,124	60	3,502	101.6***	3.43
Total	4,134,967	71			

\*Significant at the F .95 value.

\*\*\*Very highly significant at the F .995 value.

the difference in the watt-hour consumption among the ovens was highly significant.

2. For the various methods of preparing potatoes for baking, the differences in the baking time were more significant than the watt-hour consumption.

3. Significant differences existed in time and watt-hour consumption between methods in the individual ovens.

4. Variations existing between ovens for the individual method, were not chance differences.

As the foil methods require a longer time to prepare for baking as well as for the baking process and consume more electrical energy than the oiled or plain method, the homemaker may choose between appearance and heat retention or economy and family preference.

Although all the ovens required practically the same baking period, a wide difference existed in watt-hour consumption. The Toast-R-Oven with limited baking area preheated in a very short time and required the least amount of electrical energy. The homemaker may be influenced by the baking mass in choosing the baking appliance best suited to her needs.



## CHAPTER V

### SUMMARY

#### I. SCOPE OF STUDY

The purpose of this study was to compare baking time and watt-hour consumption in baking potatoes to an internal temperature of 210° F. wrapped in aluminum foil shiny side out, dull side out, plain, and oiled in a range oven, Rotisserie Oven, and Toast-R-Oven at a 425° F. setting. For the study six lots of four Idaho Russet potatoes, obtained from a local wholesale distributor, were baked in each oven. The tests were conducted in the spring of 1963.

For each method, data were collected on room temperature, humidity, time of day, preheat time, total baking time, watt-hours to preheat, and total watt-hours required to bake. The total baking time and total watt-hour consumption includes the preheat time and preheat watt-hour consumption. Two potentiometers recorded oven temperature and internal potato temperature. Potato size, weight, and temperature, room temperature, oven setting, point of doneness and line voltage were controlled.

#### II. PRINCIPAL FINDINGS

Heat retention of the foil wrapped potatoes and a tender, moist skin for the oiled potato were the only differences among the baked potatoes noted upon inspection. The order of increasing baking time for the

ovens was Rotisserie Oven, Toast-R-Oven, and range oven. The order of increasing watt-hour consumption was Toast-R-Oven, Rotisserie Oven, and range oven. If the same quality potato can be attained in about the same length of time and with less electrical energy consumption in the small ovens, then economy of operation can be claimed.

The only real difference observed among the four methods was the increased time and watt-hour consumption for the foil wrapped potatoes versus the plain and oiled potatoes. It made little difference in having the shiny side to the inside or outside. The plain and oiled methods have little difference between them as far as time and watt-hours are concerned.

### III. CONCLUSION

Because of the heat reflection of foil, a higher temperature than 425° F. is required to have the same baking period as that of the plain or oiled method. The resulting decreased baking time will result in increased energy consumption. Heat retention and less oven clean-up time seem to be advantages for using foil. A choice between the plain and oiled method may be a matter of personal preference.

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## APPENDIX

TABLE V

BAKING TIME AND WATT-HOUR CONSUMPTION OF THE RANGE OVEN  
FOR BAKING POTATOES BY FOUR METHODS

Test number	Baking time								Watt-hour consumption			
	Shiny aluminum		Dull aluminum		Plain		Oiled		Shiny aluminum	Dull aluminum	Plain	Oiled
	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.				
1	51	30	51	32	41	40	35	10	1036	1008	923	828
2	47	45	50	30	37	08	39	51	837	874	901	894
3	55	37	41	30	46	20	32	05	804	902	956	989
4	49	01	46	57	36	41	39	00	953	1007	899	1011
5	49	56	55	46	38	52	39	05	1018	1037	870	972
6	49	00	42	17	40	00	34	15	968	1050	975	965
Average	50	28	48	05	40	07	36	34	936	980	921	943

TABLE VI

BAKING TIME AND WATT-HOUR CONSUMPTION OF THE ROTISSERIE OVEN  
FOR BAKING POTATOES BY FOUR METHODS

Test number	Baking time								Watt-hour consumption			
	Shiny aluminum		Dull aluminum		Plain		Oiled		Shiny aluminum	Dull aluminum	Plain	Oiled
	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.				
1	34	20	50	20	35	00	32	04	623	838	654	694
2	46	35	51	00	34	33	42	15	798	856	657	795
3	45	43	47	29	38	43	46	20	802	819	710	749
4	42	56	54	00	33	25	33	48	737	909	625	646
5	42	25	47	40	36	37	36	44	733	799	725	697
6	40	22	42	45	34	32	36	44	685	752	658	704
Average	42	04	48	52	35	28	37	59	730	829	671	714



TABLE VII

BAKING TIME AND WATT-HOUR CONSUMPTION OF THE TOAST-R-OVEN  
FOR BAKING POTATOES BY FOUR METHODS

Test number	Baking time								Watt-hour consumption			
	Shiny aluminum		Dull aluminum		Plain		Oiled		Shiny aluminum	Dull aluminum	Plain	Oiled
	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.				
1	43	43	39	33	41	00	37	35	378	368	411	308
2	51	16	40	07	41	25	36	38	366	308	486	369
3	58	00	49	24	41	32	37	30	413	369	431	324
4	60	00	50	00	41	00	36	15	585	370	392	354
5	40	00	33	56	42	05	32	25	440	312	379	393
6	55	07	41	36	41	31	33	53	399	370	428	358
Average	51	21	42	26	41	26	35	43	430	350	421	351